From:	Ohio Power Siting Board
To:	Puco Docketing
Subject:	public comment 18-1607-EL-BGN, 17-2295-EL-BGN, and 18-0488-EL-BGN [ref:_00Dt0GzXt._500t0GHUsT:ref]
Date:	Monday, March 25, 2019 12:02:29 PM
Attachments:	karst letter 2.docx scankarst by aden.pdf

---------- Forwarded Message ----------
From: Sharon Schreiner [weedsfloral@gmail.com]
Sent: 3/24/2019 11:36 AM
To: contactopsb@puco.ohio.gov
Subject: Rejection of Emerson Creek Wind Project due to Impact on Karst

Matt
Please post the following attachments to the following Pending Case Numbers: 18-1607-EL-BGN, 17-2295-EL-BGN, 18-0488, EL-BGN
Thank You,

Sharon Schreiner
Groton Township - Erie County

ref:_00Dt0GzXt._500t0GHUsT:ref

Case Numbers: 18-1607-EL-BGN, 17-2295-EL-BGN, 18-0488, EL-BGN

The Karst

My name is Sharon Schreiner, I am a resident of Groton Township, within the proposed Emerson Creek Wind project. I am adamantly opposed to this project.

In the application by Firelands LLC the Emerson Creek project area lies on the Karst of the Bellevue Quadrangle Terrain and in an area delineated by the Ohio EPA as a Source Water Protection Area. This Karst terrain is riddled with more than 1000 sinkholes including the largest in the state which is in Bellevue. The application includes a map of the great number of wells throughout the area. These wells are connected by aquafers. The Karst impact extends far beyond that of the project area. I am an adjacent land owner and my well, natural spring and sink hole do not lie within the footprint of the project: therefore, they are not even being considered in the study. I could be adversely be affected by the Karst disruption as a result of the building of turbines in the area.

I have asked Apex several questions regarding the potential adverse effects of the installation of the heavy concrete base structures on the drainage in this area. One particular concern that we have is water runoff? This area is also part of the Pipe Creek watershed. The watershed collects runoff and carries nutrients from a 48.5 square mile area, flowing north to Lake Erie. This runoff contributes to algal bloom that has become a troublesome issue in the lake. Will industrial wind turbines make it make it worse?

The Karst and the water shed are both part of this geological water distribution system. Both systems are significantly affected by flooding. Flooding has always been an issue in this area associated with heavy rainfall and contributes to possible contamination of wells. Will we now experience more flooding when there is moderate rainfall due to the large concrete basses? We were referred to an Apex Engineer who had no answers and eventually just stopped communicating with us. We were told we just needed to wait until the application was filled then read the report ourselves. We are now reading the application but there are no answers. This subject is treated very lightly with little concern on the part of Apex although it should be an area of significant concern.

We have yet to get a straight answer from Apex other than they will make sure that bad things won't happen. And how will they do that? Grading around the turbines we are told. Who will oversee the installation process? What if our wells get contaminated? The Apex answer to that question was that they would dig us a new well. Guaranteed? Of course not! One woman at the last trustee meeting in Groton Township was told she could always hook into the municipal water system. The rep said they would pay for that hook up but would they pick up her water bills? She uses a significant amount of water in her farm operation. She was told by the Apex representative that he had to look into it and get back to her. She is still waiting.

Another question asked was: what if they hit water during their boring or digging of the foundations? That is a real possibility. There is an underground river running through here. We were told that the water would be drained, and stored in a reservoir that they would construct, then put it back or they would just fill the void with grout. Really???? Think about it. This is home to the Seneca Caverns and 1000 sink holes.

In conclusion: I believe that the Karst is not an issue that should be trifled with. It is serious. It is unique and a fragile geological area. It is significant! And the applicant of this project is not doing their due diligence in regards to the potential ramifications should the Karst be damaged or even disturbed.

Karst of the Bellevue Quadrangle and portions of the Clyde and Castalia Quadrangles, Ohio

by

Douglas J. Aden, with GIS and cartography by Dean R. Martin

Introduction

Karst terrain forms by dissolution of carbonate rocks, such as limestone or dolomite, or evaporites, such as gypsum or salt, and is characterized by features including sinkholes, disappearing streams, caves, and springs. *Sinkholes* (or *sinks*) are enclosed depressions that do not usually hold water; they often have a "throat" or opening at the bottom where they drain to the subsurface. When a stream flows into a sinkhole, it is known as a *disappearing stream* or *losing stream*. Water flowing into the ground can cause solution enlargement of natural fractures in the rock and eventually can grow into caves. In Ohio, a *cave* is defined as "...a naturally occurring void, cavity, recess, or system of interconnecting passages beneath the surface of the earth or within a cliff or ledge..." (State of Ohio, 1989).

The many passageways formed in karst terrain allow for high connectivity between the land surface and the water table. These passageways permit water to bypass soil and rock layers that filter out contaminants. Consequently, when compounds such as fertilizers, pesticides, and waste enter sinkholes, they are rapidly transported to the water table and quickly pollute water wells, streams, and rivers. When water exits these solutional features, a *spring* is formed. Such springs enable release of these contaminants at the surface.

The different types of karst features may pose infrastructure complications; roads, utilities, houses, and other facilities built in karst areas are at risk of subsidence, collapse, or other damage. In order to provide a reference for future planning on both the local and regional scale, the Ohio Geological Survey has produced this map book identifying the known and suspected karst areas in the vicinity of Bellevue, Ohio.

Previous Work

Karst areas have been studied in Ohio for many years. In the 1980s and 1990s, karst was researched for the proposed Superconducting Super Collider and was mapped statewide to determine areas suitable for storage of low-level nuclear byproducts. Ohio's preliminary map of karst features (Pavey and others, 1999) was completed in 1997 and released in 1999; it since has been updated with new data in 2003, 2005, and 2007 and will be updated again in the near future.

In the spring of 2008, severe karst-related flooding occurred in Bellevue and initiated increased concern regarding Ohio's geohazards (Raab and others, 2009; Pavey and others, 2012). From 2011 to 2012, karst was mapped in the Delaware County region (Aden and others, 2011) and in the Springfield and Donnelsville 7.5-minute quadrangles (Aden 2012). Finally, from fall 2012 to spring 2013 karst was mapped in the Bellevue 7.5-minute quadrangle and parts of the Clyde and Castalia quadrangles.

Methodology

A digital elevation map (DEM), generated from LiDAR (Light Detection and Ranging) data, was used to create a map layer that identified low, enclosed areas. To locate potential sinkholes, these low spots were cross referenced with known karst points, bedrock geology, aerial photography of multiple sources and ages, soil maps, glacial drift thickness maps, and water well logs. Suspect locations were then visited in the field, evaluated, and photographed. Through this process many of the LiDAR returns were found not to be sinkholes; features such as building foundations, broken field tiles, steep-walled streams, road culverts, and glacial features often produced enclosed areas

similar in shape to sinkholes. Many of these misleading features were eliminated remotely using both 6-inches-per-pixel aerial photography and experience from past field verification. However, many points remained that could not be distinguished remotely and these were visited in the field.

Results

The resulting karst feature data set was overlain on four different geologic data sets—the Land Surface, the Bedrock Geology, the Bedrock Topography, and the Drift Thickness maps—to show how the features are related to the local geology. The first of these is the Land Surface map (p. 5), which shows the 107 two-km^2 tiles and the 7.5-minute quadrangles that form the project area overlain on the DEM of the land surface. The Bellevue quad was the core project area. However, some adjacent points were mapped as time allowed, particularly in Clyde and Castalia; these areas will be completed as part of next year's project. The land surface map shows that in Bellevue sinks are concentrated to the south and east while springs are found down gradient north and west.

On the Land Surface map, tiles outlined in red contain the karst features identified through this project. No karst was identified in black-outline tiles. In total there are 997 karst features, including 29 springs, in 107 tiles. On the top left of each aerial imagery page (p. 9–68) is a Tile Number that references the corresponding numbered tile on the four overlay maps.

There are four types of karst features identified on each map:

- Red circles indicate field-verified features, i.e., those that have been visited in the field and confirmed as karst.
- Orange circles indicate sites that were visited but could not be verified at the time, for example a suspicious depression that is flooded or that lacks an active sink throat and cannot be clearly classified.
- Yellow circles represent areas with suspect characteristics, such as a distinct LiDAR depression, but where access to the property could not be gained or where there was not enough time to check the point.
- Blue squares represent springs, including "blue holes," where water was found flowing from the subsurface, primarily to the north.

The next overlay map is the Bedrock Geology map (p. 6). This map shows that the karst features are forming primarily by dissolution of the Columbus Limestone; however, it is thought that the Salina undifferentiated below is also affecting the sinks. The Salina contains beds of the mineral anhydrite, which alters to gypsum by hydration. This change causes swelling of about 40 percent (Boggs, 2006), which could help to fracture surrounding rocks; but more importantly, gypsum is easily dissolved by additional ground water, removing roof support and leading to collapse. In the Bellevue region there are two main ways that karst is expressed: one where catastrophic collapse forms a steep-walled, cone-shaped depression with active sinking and a second that is much more broad and shallow and may or may not have an active sink throat where water is draining into it.

Eight hundred and twenty three of the 997 karst features are within the Columbus Limestone (**Dc** on the Bedrock Geology map) with the majority of the remaining features in the Bass Islands Dolomite or Salina undifferentiated (within the **Sbi** or **Ssu**). These formations and the others on the Bedrock Geology map are buried in many places by surficial glacial materials. The elevation of the bedrock below the surficial materials is called Bedrock Topography and is shown on page 7. The elevations of the bedrock surface were subtracted from the DEM (p. 5) to create the Drift Thickness map (p. 8). Knowing the drift thickness is useful because where the drift is shallow—about 25 ft or less—sinkholes are commonly expressed. Other sinkholes may exist but were either buried beneath the glacial drift or prevented from forming by thick drift. The Drift Thickness map clearly shows that in the Bellevue area the sinkholes are concentrated along areas of thin glacial drift.

Conclusions

Of the 997 mapped karst features, 415 have photos and 838 appear on LiDAR. Of the 29 springs, nine have a LiDAR response while 20 do not. Springs do not typically show up as depressions unless a catch basin was built and subsequently failed or a build-up of material deposits from carbonate-rich spring waters forms a mound. The large number of sinks and springs found without LiDAR attests to the need for spending time in the field near known karst areas, looking for new features and talking to the public; many of the

springs in the Bellevue area were reported by a local resident, Jim Norrocky. Farmers and other land holders are still one of the best sources of local information, particularly for historical features, such as drained ponds, old mill races, and even sinkholes that have been periodically filled in.

In addition to this map book, a DVD containing the GIS data, metadata, LiDAR depressions, and photographs of many of the features is available. The GIS data contains details such as the location of each point and a brief description of what was found there. The metadata provides information on the sources and quality of the data used in this project. The LiDAR depressions layer records the depth and area for many of the sinkholes. In addition, the collection of photographs captured for many of these features can be used to monitor the growth of preexisting sinkholes and development of new karst features, as well as assisting in identification. Identification is important because karst regions are highly susceptible to pollution and structures built near them may subside. Furthermore, in the Bellevue region, low-lying karst features may be subject to flooding during periods of unusually high precipitation when the water table rises above the land surface. The maps in this report will allow areas of land development near karst features to be better planned and maintained.

Acknowledgments

The Bellevue project, the Delaware County region project, and the Springfield project were funded by the Great Lakes Geologic Mapping Coalition surficial mapping grant program.

References Cited

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Pavey, R.R., Hull, D.N., Brockman, C.S., Schumacher, G.A., Stith, D.A., Swinford, E.M., Sole, T.L., Vorbau, K.E., Kallini, K.D., Evans, E.E., Slucher, E.R., and Van Horn, R.G., with GIS and cartography by Powers, D.M., and Vogt, K.L., 1999, Known and probable karst in Ohio: Ohio Department of Natural Resources, Division of Geological Survey Map EG-1, scale 1:500,000. [Revised 2002, 2004, 2007.]

Raab, James, Haiker, Bill, Jones, Wayne, Angle, Michael, Pavey, Rick, Swinford, Mac, and Powers, Donovan, 2009, Ground water induced flooding in the Bellevue Ohio area, spring and summer 2008: Ohio Department of Natural Resources, Division of Water Technical Report of Investigation 2009-1, 19 p., accessible at <http://geosurvey.ohiodnr.gov/portals/geosurvey/PDFs/Karst/Bellevue_Final_Report.pdf>.

Further Reading

For more information on karst in Ohio, visit the Ohio Geological Survey website, **OhioGeology.com**. The following resources also provide additional information on karst and its effects in Ohio and beyond.

Ohio Department of Natural Resources

Ground Water Induced Flooding in the Bellevue Ohio Area Spring and Summer 2008, ODNR Division of Water Technical Report of Investigation 2009-1, 19 p.

Karst Flooding in Bellevue, Ohio, and Vicinity—2008, ODNR Division of Geological Survey Map EG-5, 2012, scale 1:24,000.

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Summary: Public Comment received via website electronically filed by Docketing Staff on behalf of Docketing.